REMARKS

Allowable Subject Matter

Applicants gratefully acknowledge the Examiner's indication that claim 39 is allowed, and that claims 12, 13, 29, and 30 recite allowable subject matter.

Amendment

Claim 40 is amended to correct obvious typographical errors. New claim 41 corresponds to claim 24 written in independent form.

Objection to Claim 40

Claim 40 is amended to correct the recitation of reactive mesogen additive, as suggested by the Examiner. Withdrawal of the objection is respectfully requested

Rejection under 35 USC 103(a) in view of Gass et al.

Claims 1-5, 14, 15, 17-24, 27, 28, 31-35, and 38 are rejected as being obvious in view of Gass et al. (US 5,808,716). This rejection is respectfully traversed.

Gass et al. disclose a liquid crystal display comprising a cell filled with a layer of liquid crystal material, wherein alignment layers are formed on the glass cell walls. To increase resistance to mechanical damage, molecules within the liquid crystal layer are bonded to the alignment layers. See the abstract.

At column 4, line 46 through column 6, line 15, Gass et al. described three techniques for making the cell so as to bind liquid crystal layer molecules with the alignment layers. According to the first technique described at column 4, lines 48-61, the glass cell walls are coated with alignment layers that contain reactive groups, "such as acrylate groups." After the cell is filled with ferroelectric liquid crystal material (FLC), the smectic structure is aligned by cooling. Then, at the proper temperature to obtain desired smectic layer structure, chemical bonding is induced between the reactive groups in the alignment layers and liquid crystal molecules in the FLC layer "for instance by ultraviolet illumination."

In the second technique described at column 4, line 62 – column 5, line 18, the glass cell walls are coated with conventional alignment layers, and then the cell is filled with FLC

material containing reactive mesogens, "for example mesogenic molecules containing acrylate groups." The smectic structure is again aligned by cooling from higher temperatures, and at the temperature for obtaining the smectic layer structure, chemical bonding is induced between the reactive mesogens in the liquid crystal layer and the alignment layer, "for example by ultraviolet illumination."

In the third technique described at column 5, line 19 – column 6, line 16, the glass cell walls are coated with alignment layers. In this embodiment, the alignment layers contain reactive groups. But, in addition, the FLC material used to fill the cell also contains reactive material, specifically reactive mesogens. In this situation where both the alignment layers and the FLC material contain reactive groups, "reactive groups in the FLC material and in the alignment layers have the property that selective bonding occurs primarily between a group in the FLC material and one in the alignment layer, but not between groups in the FLC material or between groups in the alignment layers."

In the rejection, it is asserted that the FLC material (a) can contain reactive mesogens having reactive groups, and (b) these reactive groups are acrylates. However, it is noted that the portions of the disclosure of Gass et al. relied on in support of this assertion relate to different embodiments. In other words, the assertion is based on separate disclosures relating to two different techniques described by Gass et al.

The rejection cites column 5, lines 18-25 in support of the assertion that the FLC material can contain reactive mesogens. This disclosure relates to the third technique, as described above. However, the description of the third technique at column 5, line 19 – column 6, line 16, never indicates that the reactive mesogens of the FLC material contain acrylates.

With regards to acrylates, the rejection cites the disclosure at column 4, lines 65-67. However, this disclosure relates to the second technique, not the third technique. See the discussion of the second technique above.

Thereafter, the rejection argues that the acrylates can be present in the form of aromatic and heteroaromatic compounds citing the disclosure of Gass et al. at column 7, lines 33-35. However, this is incorrect.

At column 7, lines 18-40, Gass et al. disclose "candidates for bonding." This disclosure gives examples of reactive groups in the alignment layer paired with reactive

groups in the liquid crystal molecules for Gass et al.'s third technique of making the cell. In the portion of the disclosure cited in the rejection, Gass et al. disclose that when **the reactive group in the alignment layer is an aromatic and heteroaromatic compound**, then the reactive group in the liquid crystal molecules can be other aromatic and heteroaromatic compounds, maleic acid derivatives, olefins, alkynes, alcohols, ethers and amines. Thus, it is the aromatic and heteroaromatic compound which is the reactive group, not an acrylate. This disclosure does not describe an embodiment wherein the alignment layer contains acrylates present in the form of aromatic and heteroaromatic compounds.

It is also noted that in this list of "candidates for bonding" at column 7, acrylates are not listed as a reactive group for either the alignment layer or the liquid crystal molecules. See also the reactions illustrated for the third technique at columns 5-6 wherein the reactive group in the alignment layer is an olefin, and reactive group in the liquid crystal molecules is a ketone, pyrrole, or mercaptan. See column 6, lines 21-24. Thus, in this third technique where both the alignment layer and the liquid crystal molecules contain reactive groups, Gass et al. do not disclose the use of acrylates.

The rejection further notes that Gass et al. disclose "selective bonding" for the reactive groups in the FLC material and in the alignment layers such that bonding occurs primarily between a group in the FLC material and a group in the alignment layer, but not between groups within the FLC material or groups within the alignment layers. Based on this disclosure, the rejection asserts that "providing the alignment layer in Gass with reactive acrylate groups by adding the same reactive mesogen additive as the one that is in the FLC … would enhance the level of selective bonding."

This assertion is unclear. It appears that the rejection is arguing it would be obvious to use acrylates as the reactive groups in both the alignment layer and the liquid crystal molecules, and that this would enhance selective bonding. But, if all the reactive groups are acrylates, this would not enhance selective bonding.

Further, the rejection argues that it would be obvious to add a reactive mesogen additive having reactive acrylate groups to the alignment layer to enhance selective bonding between the alignment layer and liquid crystal molecules. However, the rejection fails to explain how or why the use of acrylates would enhance selective bonding.

In addition, with regards to amounts, the rejection argues that Gass et al. disclose that

the FLC material can contain "a suitable proportion of reactive mesogens." See column 5, lines 21-22 which is part of the description of the third technique. Based on this disclosure, the rejection asserts that it would be obvious that the amount of "reactive mesogen additive" in the alignment layer can be varied. The rejection then concludes that it would be obvious for the amount of "reactive mesogen additive" in the alignment layer to be "less than 50%, or 0.5 to 4%, or less than 20%, or less than 10%, or less than 5%, or 1 to 2% by weight." Applicants disagree.

Firstly, Gass et al. do not disclose a reactive mesogen additive being present in the alignment layer and thus provide no suggestion as to amounts of reactive mesogen additive in the alignment layer. Secondly, Gass et al. provide no indication as to what amount is a "suitable proportion" of reactive mesogens in the FLC material, let alone in the alignment layer. Without any indication of what amount is a "suitable proportion of reactive mesogens," Gass et al. clearly provide no suggestion of amounts of less than 50%, or 0.5 to 4%, or less than 20%, or less than 10%, or less than 5%, or 1 to 2% by weight.

In addition, applicants' specification clearly discloses advantageous results for the use of small amounts of reactive mesogen additive. See the data presented in Table 1 at page 28 which indicate that for amounts of reactive mesogen additive of >0 and <5 wt. % the alignment layers provide good alignment and good adhesion. Compare, for example, applicants' claims 24 and 41. These results are clearly not suggested by Gass et al.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al. fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

Rejection under 35 USC 103(a) in view of Gass et al. and Tsuboyama et al.

Claims 6-8 are rejected as being obvious in view of Gass et al. (US 5,808,716) in combination with Tsuboyama et al. (US 5,099,344).

The disclosure of Gass et al. is discussed above. In the rejection, it is acknowledged that Gass et al. fail to disclose an alignment layer which comprises a polyimide film or an alignment layer which is a solvent processed cellulose based film. In the rejection, it is argued that Tsuboyama et al. disclose a polyimide alignment layer and a cellulose based alignment layer for use with ferroelectric liquid crystalline materials. See column 4, lines 8-

18.

However, the disclosure of Tsuboyama et al. does not overcome the deficiencies in the disclosure of Gass et al., as discussed above. Tsuboyama et al. provide no suggestion of the presence of reactive mesogenic additives in the alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al., taken alone or in combination with the disclosure of Tsuboyama et al, fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

Rejection under 35 USC 103(a) in view of Gass et al., Tsuboyama et al., and Takiguchi et al.

Claim 9 is rejected as being obvious in view of Gass et al. (US 5,808,716) in combination with Tsuboyama et al. (US 5,099,344) and Takiguchi et al. (US 4,984,873).

The disclosures of Gass et al. and Tsuboyama et al. are discussed above. In the rejection, it is acknowledged that Gass et al. fail to disclose an alignment layer which comprises triacetate cellulose (TAC) or diacetate cellulose (DAC) film. In the rejection, it is argued that Takiguchi et al. disclose a triacetate cellulose alignment layer. See column 12, lines 1-25.

However, the disclosure of Takiguchi et al. does not overcome the deficiencies in the disclosures of Gass et al. and Tsuboyama et al., as discussed above. Takiguchi et al. provide no suggestion of the presence of reactive mesogenic additives in the alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al., taken alone or in combination with the disclosure of Tsuboyama et al and/or Takiguchi et al., fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

Rejection under 35 USC 103(a) in view of Ichimura et al. and Gass et al.

Claims 10-11 are rejected as being obvious in view of Ichimura et al. (US 6,001,277) and Gass et al. (US 5,808,716).

The disclosure of Gass et al. is discussed above. Ichimura et al. disclose a liquid-crystal display device that comprises a pair of substrates, each of which is provided with a liquid-crystal alignment film, at least one the substrates having an electrode, and a liquid

crystal held between the substrates. The liquid-crystal alignment films comprise a resin that contains photoisomerizable and dichroic structural units, such as units of azobenzene derivatives and stilbene derivatives. See column 4, lines 7-47. As described at column 9, lines 31-44, the photoisomerizable and dichroic structural units may be mixed with the resin and can be chemically bonded to each other or to the resin by at least one of irradiation with light and heating.

As noted in the rejection, Ichimura et al. do not, however, disclose or suggest an alignment layer that comprises a polymer film containing at least one reactive mesogen additive, wherein the additive has unreacted polymerizable groups after preparation of the alignment layer.

As discussed above, the disclosure of Gass et al. also does not disclose or suggest the presence of reactive mesogenic additives in an alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Ichimura et al., taken alone or in combination with the disclosure of Gass et al, fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

Rejection under 35 USC 103(a) in view of Gass et al. and Komatsu et al.

Claims 25, 26, and 36 are rejected as being obvious in view of Gass et al. (US 5,808,716) in combination with Komatsu et al. (US 5,989,758).

The disclosure of Gass et al. is discussed above. It is acknowledged in the rejection that Gass et al. fail to disclose an alignment layer which has a birefringence of less than 0.05. However, it is argued that Komatsu et al. disclose an orientation substrate which is "optically isotropic." See column 24, lines 14-19. In the rejection, it is further asserted that "optically isotropic" means a birefringence of zero. Applicants disagree.

Komatsu et al. do not define what is meant by "optically isotropic." One of ordinary skill in the art reading the disclosure of Komatsu et al. does not know whether "optically isotropic" in the context of the disclosure means a birefringence of less than 1, less than 0.1, or zero, or some other value. Nothing within the disclosure of Komatsu et al. or within the rejection supports the conclusion that "optically isotropic," in the context of the Komatsu et al. disclosure, definitively means a birefringence of zero.

Moreover, the disclosure of Komatsu et al. does not overcome the deficiencies in the

disclosure of Gass et al. as discussed above. Komatsu et al. provide no suggestion of the presence of reactive mesogenic additives in the alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al., taken alone or in combination with the disclosure of Komatsu et al., fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

Rejection under 35 USC 103(a) in view of Gass et al., Tsuboyama et al. and Komatsu et al.

Claim 37 is rejected as being obvious in view of Gass et al. (US 5,808,716) in combination with Tsuboyama (US 5,099,344) and Komatsu et al. (US 5,989,758).

The disclosures of Gass et al. and Tsuboyama et al. are discussed above. It is acknowledged in the rejection that Gass et al. fail to disclose an alignment layer which has a birefringence of less than 0.01. However, it is argued that Komatsu et al. disclose an orientation substrate which is "optically isotropic." See column 24, lines 14-19. In the rejection, it is further asserted that "optically isotropic" means a birefringence of zero. Applicants disagree.

Komatsu et al. do not define what is meant by "optically isotropic." One of ordinary skill in the art reading the disclosure of Komatsu et al. does not know whether "optically isotropic" in the context of the disclosure means a birefringence of less than 1, less than 0.1, or zero, or some other value. Nothing within the disclosure of Komatsu et al. or within the rejection supports the conclusion that "optically isotropic," in the context of the Komatsu et al. disclosure, definitively means a birefringence of zero.

Moreover, the disclosure of Komatsu et al. does not overcome the deficiencies in the disclosures of Gass et al. and Tsuboyama et al., as discussed above. Komatsu et al. provide no suggestion of the presence of reactive mesogenic additives in the alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al., taken alone or in combination with the disclosure of Tsuboyama et al and/or Komatsu et al., fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

Rejection under 35 USC 103(a) in view of Gass et al. and Lacker et al.

Claim 40 is rejected as being obvious in view of Gass et al. (US 5,808,716) in view of Lacker et al. (US 4,944,576).

The disclosure of Gass et al. is discussed above. It is acknowledged in the rejection that Gass et al. fail to disclose the addition of least one reactive mesogen additive to the polymer of the alignment layer after polymerization thereof as a plasticizer to improve processability of the polymer. However, it is argued that Lacker et al. disclose that a mesogen compound inherently functions as a plasticizer, based on the disclosure at column 5, lines 40-45.

The disclosure of Lacker et al. is directed to the formation of polymer dispersed liquid crystal films (PDLC films). These are defined as films that consist of "droplets or bubbles of liquid crystal molecules (LC) dispersed in a clear or light transmitting, flexible plastic sheet or film." See column 1, lines 19-22. Lacker et al. disclose that their PDLC film is prepared by first forming dissolving liquid crystal material in a polymerizable monomer system. The resultant solution is then polymerized to form a film having a dispersion of liquid crystal bubbles therein. During polymerization, the liquid crystal molecules within the bubbles are partially aligned by application of an electric or magnetic field or by mechanical flow. See column 2, lines 57-66, and column 5, lines 36-42

At column 5, lines 42-46, Lacker et al. do disclose that, while most of the liquid crystal molecules are dispersed in the film in the bubbles, a fraction of the LC molecules are "retained in the polymer as isotropic plasticizers or as microdroplets."

It is clear that Lacker et al. do not disclose the addition of reactive mesogenic additives **after polymerization.** For the PDLC film to contain the desired LC bubbles, the liquid crystal compounds are added before polymerization. Thus, as with the disclosure of Gass et al., Lacker et al. fail to disclose the addition of least one reactive mesogen additive to a polymer film after polymerization thereof.

Additionally, the polymer film of Lacker et al. is a PDLC film, not an alignment layer. Thus, Lacker et al. provides no rationale for modifying the alignment layer of Gass et al.

Furthermore, the disclosure of Lacker et al. does not overcome the deficiencies in the disclosure of Gass et al. as discussed above. Lacker et al. provide no suggestion of the presence of reactive mesogenic additives in the alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al., taken alone or in combination with the disclosure of Lacker et al., fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,

/Brion P. Heaney/

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Brion P. Heaney, Reg. No. 32,542
Attorney for Applicants

MILLEN, WHITE, ZELANO & BRANIGAN, P.C.
Arlington Courthouse Plaza 1
2200 Clarendon Boulevard, Suite 1400
Arlington, VA 22201
Direct Dial: 703-812-5308
Facsimile: 703-243-6410
Attorney Docket No.: MERCK-3144

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